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Numerous development economists have expressed concern the past several decades about machinery substituting too rapidly for labor, especially in rural areas. They have often presumed that cheap credit encouraged this by causing input price distortions favoring capital use (e.g. Barker, p. 144; Gupta, p. 52; Johnston and Cownie, p. 574; Lele, p. 98; Little, Scitovosky and Scott, p. 87; Meier, p. 174; Mellor, p. 325; and Shaw, p. 77). Several of these economists see factor-use distortions as the primary undesirable result of cheap credit policies.

In the following discussion we ignore whether significant distortions in factor-use proportions have occurred, and whether such distortions are or are not desirable (see: Binswanger, Gotsch, McInerney and Donaldson, and Saunders). Instead, we focus on the extent to which low interest rates cause farmers to alter the combinations of productive inputs they use. We will conclude that, while low interest rates have undesirable effects on rural economies, they have negligible effects on factor-use proportions in agriculture. We will also argue that distortions in product and input prices, and that levels of investment in yield increasing research are far more important in determining the combinations of inputs chosen by producers. We conclude that

attention should be directed to more substantial financial market problems such as the effects low interest rates have on income distribution, on costs of financial intermediation, on incentives to save, and on the vitality and performance of financial institutions.

Background

The assertion that cheap credit causes over-investment in capital began to surface in development literature in the late 1960s. Those raising this argument have done so as if it were a well established fact needing little justification, amplification, or supporting evidence. While its genesis is uncertain, it is consistent with neo-Keyesians' stress on the importance of interest rates in determining levels of investment. A good deal of confusion is associated with this argument because of imprecise use of the term 'capital'. Some authors use it to denote working capital: funds or claims-on-resources that may be owned or borrowed. Others apply the term only to man-made inputs that have productive lives spanning several production periods, e.g. tractors, tubewells, and buildings. Many authors apply the term to both notions: funds and physical inputs. In the discussion that follows we apply the term 'funds' to working capital, including claims-on-resources that are borrowed. We restrict our use of the term 'capital' to physical inputs such as tractors.

When a distinction is made between funds and capital it is not readily apparent why a change in the price of funds, interest rates, should have any differential effect on the willingness of producers to use capital inputs. Interest rates on funds are one set of prices while the price of capital and other factors of production, including labor, appear to be independent of these rates. While not explicitly stated by authors making the distortion argument, it appears they use four assumptions to support this proposition. The first is that borrowers have "price astigmatism": their financial vision is blurred and they end up using some combined price of capital and interest rates on loans in making capital-use decisions. Second, borrowers have "discounting hyperopia" and tend to mimic the interest rates set on loans in fixing their individual discount rates. If this occurs, and interest rates on loans are low, the borrower would be too far sighted and overestimate the current value of future benefits from capital use. Third, governments and lenders may promote the use of additional modern agricultural technology, such as tractors, through low interest rates on loans "tied" to the purchase of capital inputs. This might cause distortions in factor-use proportions to the extent that loans can be effectively tied to increased capital use. Fourth, low interest rates may result in excess loan demand and induce lenders to concentrate cheap credit in large loans to borrowers whose

firms use relatively large amounts of capital, compared to firms that are more severely credit rationed by lenders.

Price Astigmatism

There is often a close association between borrowing and capital purchases. There are two reasons for this: first, producers often do not have sufficient liquid assets to buy large capital items. A major benefit of a well functioning financial market is it allows borrowers to purchase large items without having to wait to accumulate sufficient savings. Second, lenders are more eager to finance items that add to visible collateral than activities that do not. While difficult to prove, it is likely that an expansion in the volume of loans will increase the amount of capital purchased by producers. One must be careful, nevertheless, to separate the effect of increased access to loans from the effects changes in interest rates might have on capital use. One way to do this, in a controlled experiment, would be to hold the volume of credit used by a producer constant and vary the interest rate paid on loans. The lowest interest rate that can be charged is a minus 100 percent, a gift. There appears to be no a priori reason why a gift of money compared to a loan should induce producers to favor the acquisition of one class of inputs, or items of consumption for that matter, over another.

One might argue that because loans and capital acquisition are often closely associated, that borrowers may become

confused about the difference between the price of the loan and the price of the capital item: the borrower may have financial astigmatism and blur the distinction between these two prices. This might result in borrowers making capital-use decisions largely on the basis of the size of their periodic loan repayments and their cash flow. Since the size of the loan repayment is a combination of the interest rate charged on the loan and the price of the capital item purchased, the lower the interest rate the more eager would be astigmatic producers to buy the capital input. While some producers may make decisions in this manner, it is inconsistent with profit maximization behavior. A firm's cash flow is not a direct indication of the profitability of the use of a capital item. Changes in interest rates on loans affect the overall profitability of borrowing firms, but they do not change the relative profitability of the firm's enterprises and inputs.

Those making the price astigmatism argument must assume a good measure of economic irrationality among producers, and that many borrowers who purchase capital items are not profit maximizers. They must also implicitly assume that borrowers do not confuse the price of labor or the prices of other inputs with interest rates when borrowing is associated with the purchase of these inputs. Also, it must be assumed that the large volume of lending that takes place in informal financial markets, often at much higher interest

rates than charged in the formal market, does not bias borrowers away from capital use. The price astigmatism argument does not appear to us to be very robust.

Discounting Hyperopia

Another argument that might be used to justify accusations that low interest rates distort factor-use might be labeled discounting hyperopia. Because the benefits from investments in capital items come over several production periods, producers must apply discount rates in calculating the present value of this stream of benefits. One might argue that borrowers tend to mimic the low interest rates on formal loans in setting their personal discount rates. This would cause borrowers to be too far sighted and to overestimate the present value of future benefits from investments in capital inputs by applying too low a discount factor to future benefits.

There are two limitations to this argument. The first is that there is no obvious reason to assume that borrowers mimic interest rates on formal loans in setting their personal discount rates. For example, one would not expect a 70 year old borrower to apply the same discount rate to benefits from a capital investment with a 20 year economic life that a person 30 years old would use, even though they paid the same low rate of interest on formal loans. Also, there is no reason to believe that borrowers would internalize low interest rates on formal loans, especially when

those rates were negative in real terms. If mimicked, the negative real rates of interest would induce borrowers to add a premium to future income, a very doubtful assumption.

It is also unclear why buyers of capital would select the low interest rates applied to formal loans in setting their discount rates. Numerous rural producers in low income countries have multiple loans from both formal and informal sources, or have loans from only informal lenders. The explicit and implicit nominal interest rates on these loans may range from zero on loans from friends and relatives to reasonably high rates on short term, unsecured, small loans from other informal sources. Why would borrowers not mimic the zero rates of interest they receive from a loan made to brothers-in-law, or high rates of interest paid on small informal loans in setting internal discount rates? Again, there is no a priori reason why the borrower should use any of the rates that exist in financial markets in setting highly personal discount rates. The hyperopia argument appears to have even less vitality to it than the astigmatism argument.

Loan Tying

Another argument supporting this line of reasoning focuses on lender rather than borrower behavior. One might argue that borrowers are economically rational, but that lenders enforce loan conditions that are not in the borrower's best interests. That is, the lender is able to

tie the use of the loan to additional purchases of capital. The lender may have several reasons for doing this. First, as mentioned previously, capital items provide more secure collateral than do many other uses of borrower funds. This may cause lenders to bias their loans in favor of capital over other factors of production. The second reason is that lenders might try to promote the acquisition of capital as part of government or donor attempts to modernize agriculture. Lenders and policy makers may feel that borrowers are unable to correctly forecast the benefits of more capital use and that some measure of carrot (low interest rate loans) and stick (tying the loans to capital purchases) is required so that private and social benefit-costs are more closely attuned.

At first blush, the tying argument appears to be strong. Clearly, many of the loans made by the formal financial system in low income countries are justified on the basis of the borrower buying capital inputs or making a capital improvement. There may or may not, however, be a close relationship between the reasons used to justify a loan and the changes in uses by the borrower of marginal liquidity provided by a loan. One must clearly understand fungibility, additionality, diversion, and substitution to evaluate the ability of the lender to tie loans.

The principal reason for people inventing financial instruments was because of their interchangeability or

fungibility (Von Pischke and Adams). A unit of money owned by a borrower is identical to units of money borrowed, units of money received from various sources of income, or funds received from sale of assets. Money can be used to purchase any good or service available in the market. Once borrowed, monies provided by a loan are indistinguishable from other funds owned or borrowed by the producer. Because of this, one cannot determine a loan's impact on a borrower's pattern of expenditures by looking at the justification given for obtaining a loan. In many cases, the tying of loans to the purchase of specific items is a joint charade played by lenders and borrowers to allow policy makers to feel they are controlling resource allocation.

The correct gauge of loan tying is additionality. It measures the differences in a borrower's activities with and without a loan, other things being equal. The hypothetical information shown in Table 1 illustrates additionality. The table is divided into two parts and presents, in highly simplified form, the sources and uses of liquidity by a farm household over a period of time. It shows the sources and uses of liquidity both with and without a new formal loan. The table shows that, when given access to a formal loan of $1,000, the household will expend an equivalent amount on the purchase of a new capital input such as a tractor. If the household had not planned to allocate any of its liquidity to the purchase of the tractor in the absence of

TABLE 1

SOURCES AND USES OF LIQUIDITY

IN A FARM HOUSEHOLD WITHOUT

AND WITH A FORMAL LOAN

Sources of Liquidity

	Amounts $	
	No Loan	With Loan
1. Borrowed formal funds	0	1,000
2. Borrowed informal funds	1,000	1,000
3. Owned funds	1,000	1,000
4. Sale of assets	1,000	1,000
5. Other income	4,000	4,000
Total	7,000	8,000

Uses of Liquidity

	Amounts $	
	No Loan	With Loan
A. Capital purchases	0	1,000
B. Non-capital input purchases	2,000	2,000
C. Buy non-productive assets	1,000	1,000
D. Other expenditures	4,000	4,000
Total	7,000	8,000

a loan, and if an amount exactly equal to the value of the loan were expended on the tractor, one could say that the loan was associated with 100 percent additionality; an additional amount equal to the value of the loan was expended on the activity specified in the loan documents over what the household would have spent on that activity without the loan.

The example in Table 1 could be altered to represent a case where there was zero capital additionality from the use of a new formal loan. Because of fungibility the household may decide to borrow $1,000, state that the purpose is to buy a tractor, but instead divert the use of that additional liquidity to other expenditures such as increasing household consumption. This diversion, in most countries would be illegal, yet be very hard to control or detect where a large number of geographically disbursed borrowers are involved. Diversion is especially hard to detect when the borrower is involved in the activity funded by the loan prior to receiving the loan. That is, the borrower may already have several pieces of equipment similar to the one specified in the loan document.

The borrower may also realize zero additionality through financial substitution. For example, the borrower may plan to buy a tractor for $1,000 with or without a loan. A loan of a thousand dollars to buy a tractor would simply add to the stock of funds that could be spent on other

household activities. If this additional liquidity were used to buy other productive inputs such as labor, there would be zero additionality in capital purchases, but 100 percent additionality in the purchase of labor, an expenditure not authorized in the loan agreement. This financial substitution of uses of liquidity is perfectly legal and extremely costly for lenders to control in rural areas. Because of the large number of actors involved in formal rural financial markets, the geographic disbursion of lending activities, and the multiple sources and uses of liquidity in most borrowing firm-households, it is impossible for lenders to exercise a large measure of control over loan use.

It would be undesirable if lenders were able to force substantial degrees of additionality on borrowers. Doing so would result in lenders forcing borrowers to do something that they would otherwise not do. Realizing 100 percent additionality would mean that, without a loan, borrowers were unwilling to put any of their liquidity into the activity specified in the loan contract. If borrowers are economically rational, this would mean that they were forced to invest in an activity that they consider to be low on their list of expenditure alternatives. If this were the case, one should expect that rational borrowers would exercise a good deal of effort in diverting a major part of the

liquidity provided by the loan to other activities that were higher on their priority list of activities.

At the same time, a large measure of financial substitution would indicate that the lender was funding an activity that was quite high on the list of things that borrowers wanted to do, whether or not they received a loan. Under either the diversion or financial substitution case, the borrower would be diverting claims on resources to activities that were expected to give the borrower more satisfaction or returns at the margin than the activity specified in the loan document. While an urban lender might be able to insure that most liquidity provided by a loan went into building a steel plant, and also expect that this resulted in a good deal more capital investment, the same measure of control does not exist in rural lending.

The fungibility features of financial instruments can be only partially neutralized by granting loans in kind. Granting and repaying loans in kind may lend a stronger aura of loan-tying than granting loans via financial instruments. This is more shadow than reality, however. If farmers are forced to take a loan in kind, say in the form of sacks of fertilizer, they may find it in their best interest to sell the fertilizer in the grey or informal market and use the proceeds to buy other inputs or goods that bring more satisfaction. Even in those cases where the loan in kind cannot

be resold (e.g. a tubewell, or a building) the loan may be associated with a large measure of financial substitution.

Granting loans in kind reinstitutes barter and destroys the benefits of finance. In many cases granting loans in kind simply increases the lender's and borrower's transaction costs of getting the combinations of inputs and consumption goods that are most desirable to the borrower. Fortunately, the workings of informal markets largely neutralize the inefficient effects of loan tying on resource allocation. With the heterogeneity that exists in rural firms and regions, it is hard to see how credit planners in the capital city can tie loans to activities that have economic returns as high as those daily discovered by individual producers-borrowers.

Loan Concentration

Recent research in several less developed countries has uncovered a close inverse relationship between the rate of interest charged on agricultural loans and the concentration of these loans in the hands of relatively few people. Gonzalez-Vega has termed this the "Iron Law of Interest Rate Restrictions": the lower the real rate of interest charged on loans, the more heavily concentrated will be the loan portfolio. He has also outlined the microeconomic forces that drive the financial intermediaries, be they private or government owned, to conform to this law. One might argue that these cheap loans tend to be concentrated in the hands

of borrowing firms that are more capital intensive, by their very nature, than are the firms that are rationed-out of the credit system by financial intermediaries.

Research has shown that firms receiving a large amount of the cheap credit tend to be relatively large, are managed by people with extensive previous access to the financial system, and are individuals who often have political clout. These preferred borrowers tend to use machinery, have a good deal of assets tied up in buildings, irrigation, and other equipment that is typical of firms managed by absentee ownership. Labor services often makes up a relatively small part of the resource services used in these borrowing firms. One might argue that lending more funds to these capital intensive firms would distort the overall use of resources across firms (those with and without loans) in favor of capital. This might occur even though the capital intensive firms did not alter their factor proportions with the access to additional funds.

If loans were heavily concentrated in the hands of capital intensive firms, one should expect the amount of capital used by these firms to increase because of the "loan volume" effect. Because of the previously discussed very weak effects of interest rates on the combinations of inputs that borrowers choose to use, one should not expect significant distortions in factor use within individual borrowing firms. There is also no a priori reason to conclude that

higher interest rates, which forced lenders to more widely spread their loans, would cause previously credit-rationed borrowers to acquire capital inputs that are equal to, greater than, or less than the decrease in purchases of capital by large producers that now have less access to loans.

One might also argue that it is easier for lenders to enforce tying when loans are concentrated in relatively large amounts. That is, it may be easier for a lender to closely monitor diversion and substitution of funds when only a relatively small number of rural borrowers receive most of the cheap credit. In evaluating this argument, one must remember that even when rural loans are concentrated in the hands of relatively few people, the lender may still be working with hundreds of widely disbursed borrowers. Also, these large borrowers typically have a broad range of economic activity that may include combinations of several farm firms, non-farm rural firms, and urban economic interests.

Many of these large borrowers justify loans on the basis of adding capital inputs to an existing stock rather than doing something that is entirely new. These conditions allow borrowers to easily "funge" funds from one use to another, to divert funds from one firm or activity to another, and to substitute borrowed for owned funds. Large complex firms that receive the bulk of the rationed loans

likely have more latitude to exercise fungibility than do smaller, less complex firms that tend to be rationed out of the credit market when interest rates are low. Further, because these large borrowers are relatively well educated and economically sophisticated, it is unlikely that the lender can force them to acquire capital inputs that are inconsistent with the borrower's economic interests.

Clearly, low interest rates force lenders to concentrate cheap loans in the hands of firms that are inclined to be capital intensive. It is much less clear whether the end result of this loan concentration is any significant change in factor-use proportions in agriculture over what would exist with higher interest rates. Fungibility likely neutralizes most potential distortions.

More Significant Problems

While difficult to prove empirically, it appears to us that interest rates on loans have, at most, a weak effect on borrowers' factor proportion decisions. The price of inputs, their expected yields, and the product prices that borrowers expect to receive are far more important determinants of the combination of inputs producers choose to use. While factor proportions have received most of the casual attention paid to the adverse effects of low interest rates, recent research has shown that at least four other issues are much more important. These are (1) the impacts of low interest rates on income distributions, (2) on the

costs of financial intermediation, (3) on the willingness of people to save in financial form, and (4) on the strength and vitality of the financial system itself.

Recent research in several countries is showing that negative real rates of interest, loan concentration, and in some cases substantial amounts of loan defaults in rural financial markets are resulting in large transfers of puchasing power to relatively wealthy borrowers through formal financial markets (e.g. Adams and Tommy, Gonzalez-Vega, Vogel). In Brazil, Mexico, and India these yearly income transfers are measured in billions of dollars. In some countries, the workings of financial markets are having a stronger adverse impact on the distributions of income than are any other force. Very little has been said about this in the development literature; it deserves much more attention.

Recent research has also shown that low interest rates may be causing major increases in costs that both lenders and borrowers experience in carrying out financial transactions (Ahmed, Cuevas and Graham, Ladman, and Nyanin). Low interest rates, especially when combined with large amounts of funds from governments or donor agencies, force lenders to ration and target loans in largely futile attempts to meet political objectives. This process forces many borrowers to incur additional loan transaction costs to gain access to the financial system, and also results in lenders

incurring more loan transaction costs in appearing to target loans. Inflated lender transaction costs are often a major factor undermining their financial integrity. Low interest rates on loans also force intermediaries to pay even lower rates on deposits. This makes it impossible for the intermediary to mobilize significant amounts of private deposits, and forces the lender to be highly dependent on government and donor agencies for funds. This, in turn, makes the lender susceptible to political intrusions. It is difficult for the lender to refuse to make loans to influential borrowers who are judged to be unworthy of credit, using non-political criteria. Politics further impedes loan collection and encourages default. This undermines the financial intermediary's balance sheet and income statement and it also diverts scarce managerial time to stroking and responding to political powers and trying to collect bad debts.

A properly functioning financial market should play an increasingly larger role in mobilizing private savings in a growing economy. Providing opportunities and incentives to save through financial markets can be a strong force in increasing a country's overall savings performance. In most low income countries financial markets play minor roles in providing these savings opportunities and incentives. Low nominal rates of interest combined with substantial amounts of inflation result in negative real incentives for those

who want to save in financial form, especially in rural areas. With the small volume of savings that is offered to financial intermediaries at these low rates, the intermediary has little incentive to improve savings deposit services. This is reflected in relatively large minimum balance requirements on savings accounts, awkward hours for withdrawing savings, and intermediaries who are unwilling to offer rural people any deposit facilities in their institutions. Recent research on savings behavior in rural areas of low income countries shows there is a much larger, latent voluntary savings capacity there than has heretofore been thought (Adams; Ong, Adams and Singh; and Vogel). No one can measure the amount of consumption that has been encouraged by low interest rates and the lack of appropriate savings facilities in rural areas of low income countries. The amount, nevertheless, is likely a very large multiple of all of the foreign assistance provided to low income countries!

It is time for more development economists to remove cataracts from their view of financial market operations. The very superficial attention that has been given in the past to how interest rates and the operations of financial markets affect factor proportions seems to us to be a minor issue compared to other, largely neglected, results of cheap credit policies in low income countries.

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